

CLAIM:

1. A semiconductor device structure, comprising:
a first structure comprising a semiconductor material;
a second structure adjacent the first structure, the second structure comprising insulative material and forming an interface with at least a portion of the first structure;
passivation species within the second structure, the passivation species comprising hydrogen species derived from an ammonia exposure; and
an encapsulant layer overlying the interface so as to substantially retain the passivation species in the second structure.
2. The semiconductor device structure of Claim 1, wherein the first structure comprises at least a portion of a semiconductor substrate.
3. The semiconductor device structure of Claim 2, wherein the first structure comprises doped regions of the semiconductor substrate.
4. The semiconductor device structure of Claim 2, wherein the semiconductor substrate comprises an upper portion of a single-crystal silicon wafer.
5. The semiconductor device structure of Claim 1, wherein the second structure overlies the first structure.
6. The semiconductor device structure of Claim 5, wherein the second structure comprises a tunnel dielectric layer.
7. The semiconductor device structure of Claim 6, wherein the tunnel dielectric layer comprises silicon oxide.
8. The semiconductor device structure of Claim 6, wherein the tunnel dielectric layer comprises tantalum pentoxide.
9. The semiconductor device structure of Claim 6, wherein the tunnel dielectric layer has a thickness between about 10 Angstroms and about 300 Angstroms.
10. The semiconductor device structure of Claim 1, wherein the second structure comprises the encapsulant layer.

11. The semiconductor device structure of Claim 10, wherein the second structure comprises a tunnel oxide layer and the encapsulant layer comprises a nitrogen-containing portion of the tunnel oxide layer.

12. The semiconductor device structure of Claim 11, wherein the second structure comprises silicon oxide and the encapsulant layer comprises silicon oxynitride.

13. The semiconductor device structure of Claim 11, wherein the encapsulant layer comprises at least a top surface of the tunnel oxide layer.

14. The semiconductor device structure of Claim 1, wherein the encapsulant layer comprises nitrogen.

15. The semiconductor device structure of Claim 14, wherein the nitrogen is from the ammonia exposure.

16. The semiconductor device structure of Claim 1, wherein the encapsulant layer comprises silicon nitride.

17. The semiconductor device structure of Claim 1, wherein the encapsulant layer comprises silicon oxynitride.

18. The semiconductor device structure of Claim 1, wherein the encapsulant layer is adapted to limit exposure of the second structure to outgassing of OH and H during subsequent processing.

19. The semiconductor device structure of Claim 1, further comprising a substantially conformal liner layer comprising an insulating material, the liner layer overlying at least the first structure and the second structure.

20. The semiconductor device structure of Claim 19, wherein the liner layer forms a diffusion barrier against hydroxyl and hydrogen species.

21. The semiconductor device structure of Claim 19, wherein the liner layer includes silicon nitride, silicon oxynitride, or a multiple layer laminate including one or both of nitride and oxynitride.

22. A semiconductor device structure, comprising:
a first structure comprising a semiconductive material;

a second structure adjacent the first structure, the second structure comprising insulative material and forming an interface with at least a portion of the first structure;

passivation species within the second structure in the presence of at least a portion of the interface, the passivation species comprising hydrogen species derived from an ammonia exposure; and

an encapsulant layer overlying the interface so as to substantially contain the passivation species in the presence of at least the portion of the interface.

23. The semiconductor device structure of Claim 22, wherein the second structure comprises the encapsulant layer.

24. The semiconductor device structure of Claim 22, wherein the encapsulant layer comprises silicon nitride.

25. The semiconductor device structure of Claim 22, wherein the encapsulant layer comprises silicon oxynitride.

26. The semiconductor device structure of Claim 22, wherein the second structure comprises a transistor gate oxide.

27. The semiconductor device structure of Claim 22, wherein the encapsulant layer is adapted to limit exposure of the second structure to outgassing of OH and H during subsequent processing.

28. The semiconductor device structure of Claim 22, wherein the encapsulant layer comprises nitrogen from the ammonia exposure.

29. A semiconductor device structure, comprising:

a first structure comprising at least one of a semiconductive material and a conductive material;

a second structure adjacent the first structure, the second structure comprising insulative material and forming an interface with at least a portion of the first structure;

passivation species permeating at least a portion of the first structure at the interface, the passivation species comprising hydrogen species derived from ammonia; and

an encapsulant layer positioned over at least the first structure so as to substantially contain the passivation species in the presence of at least the portion of the first structure.

30. The semiconductor device structure of Claim 29, wherein the second structure comprises the encapsulant layer.

31. The semiconductor device structure of Claim 29, wherein the encapsulant layer comprises silicon nitride.

32. The semiconductor device structure of Claim 29, wherein the encapsulant layer comprises silicon oxynitride.

33. The semiconductor device structure of Claim 29, wherein the second structure comprises a transistor gate oxide.

34. A passivating system for use in semiconductor device structures, comprising:
hydrogen species derived from ammonia for permeating and passivating at least an interface between a first structure comprising at least one of a semiconductive material and a conductive material and a second structure comprising an insulative material; and

an encapsulant layer positioned so as to substantially prevent the hydrogen species from escaping the interface.

35. The passivating system of Claim 34, wherein the encapsulant layer comprises silicon nitride.

36. The passivating system of Claim 34, wherein the encapsulant layer comprises silicon oxynitride.

37. The passivating system of Claim 34, wherein the second structure comprises the encapsulant layer.

38. The passivating system of Claim 34, wherein the second structure comprises a transistor gate oxide.